

FIG. 1

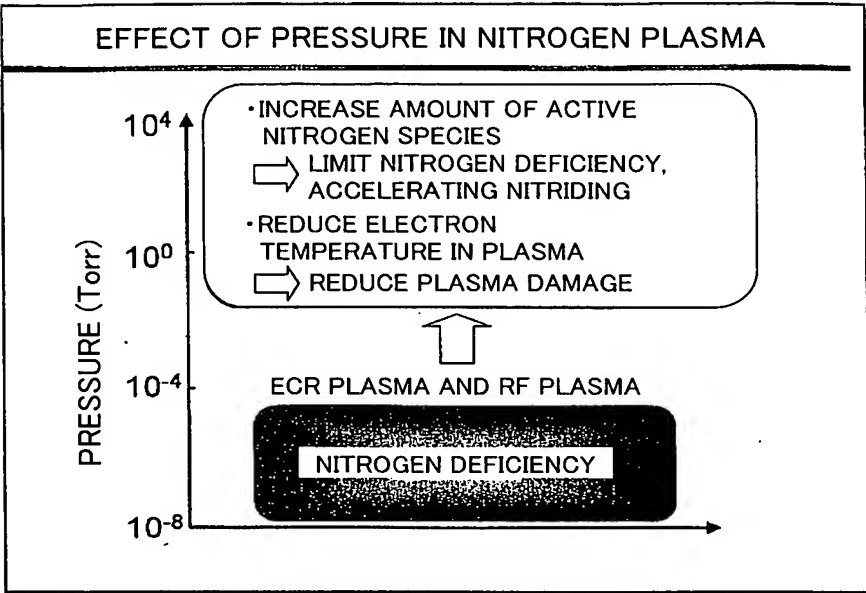


FIG. 2

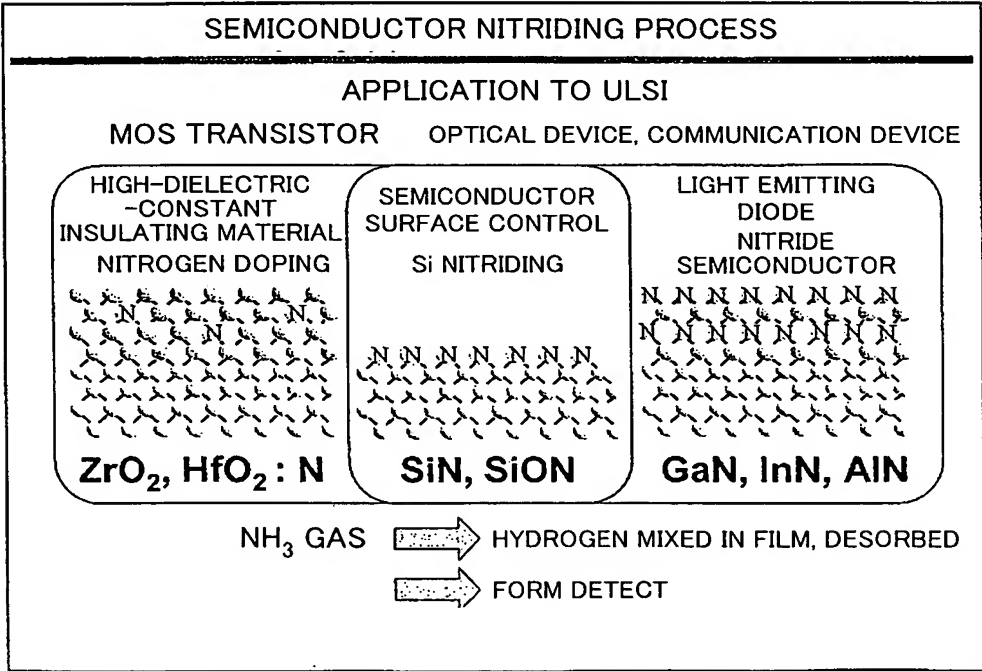


FIG. 3

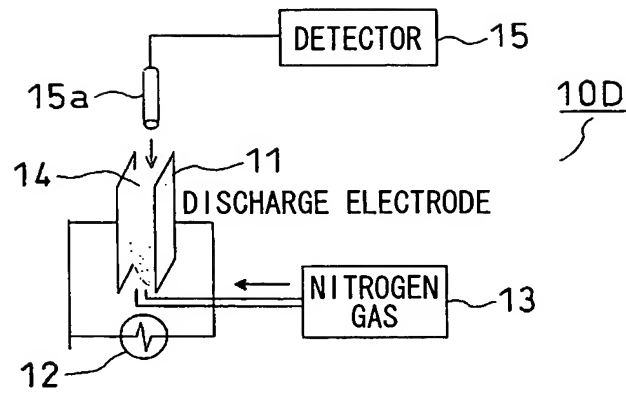


FIG. 4

45 Torr

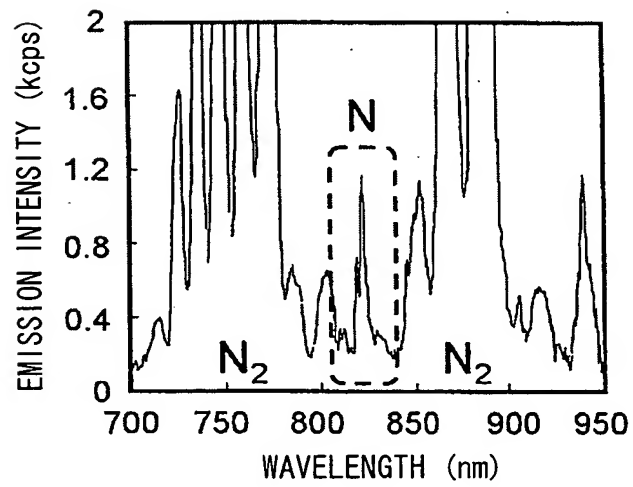


FIG. 5

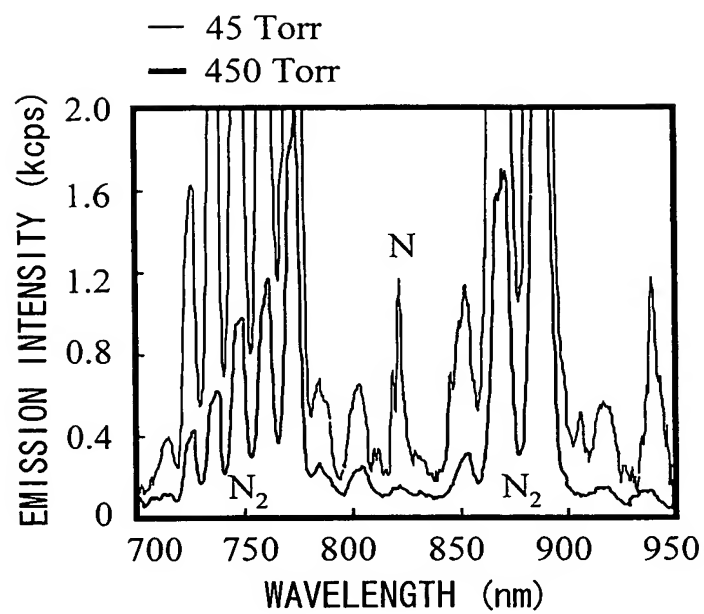


FIG. 6

500 Torr

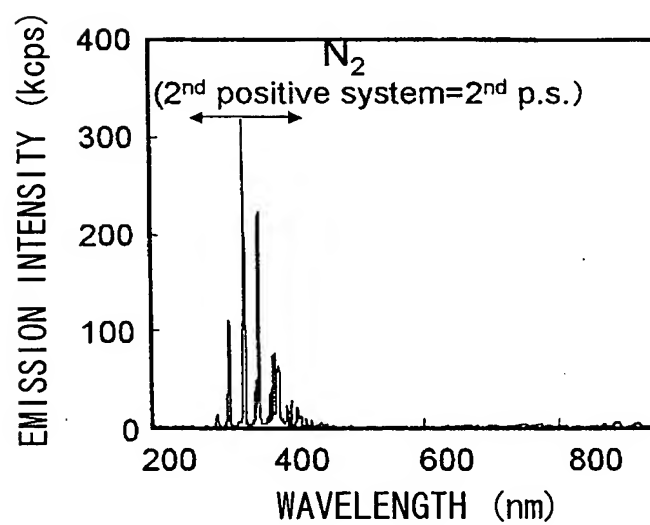


FIG. 7

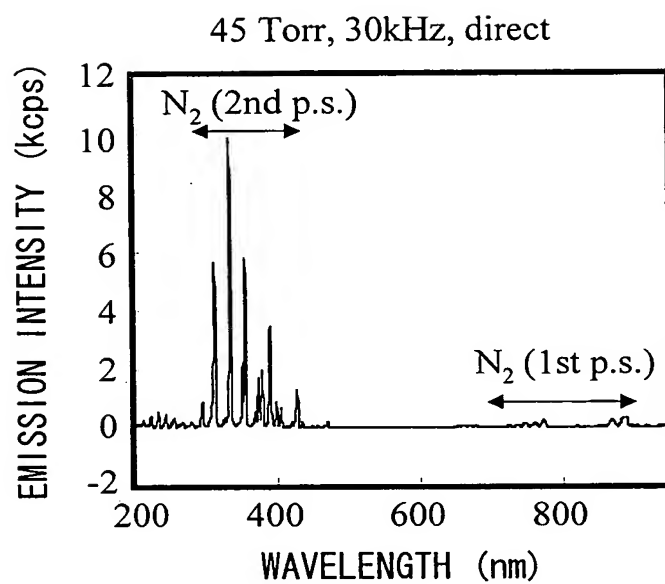


FIG. 8

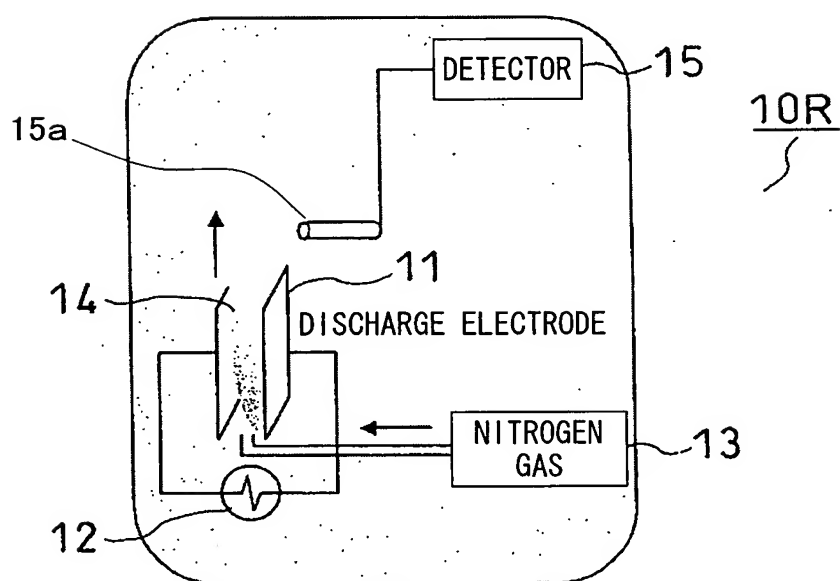


FIG. 9

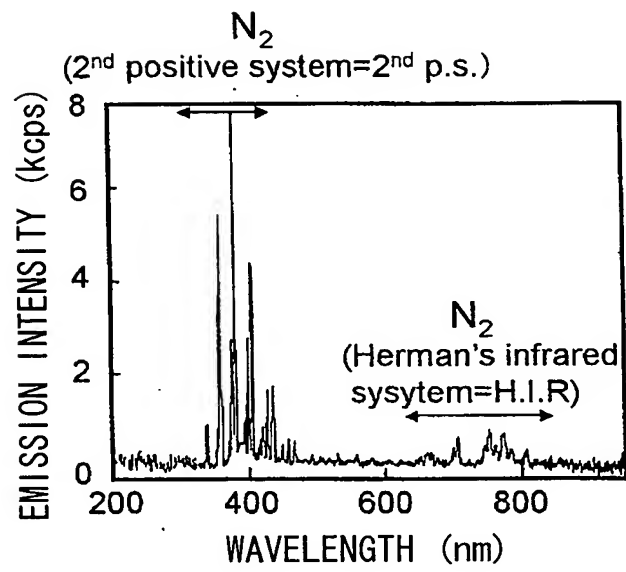


FIG. 10(b)

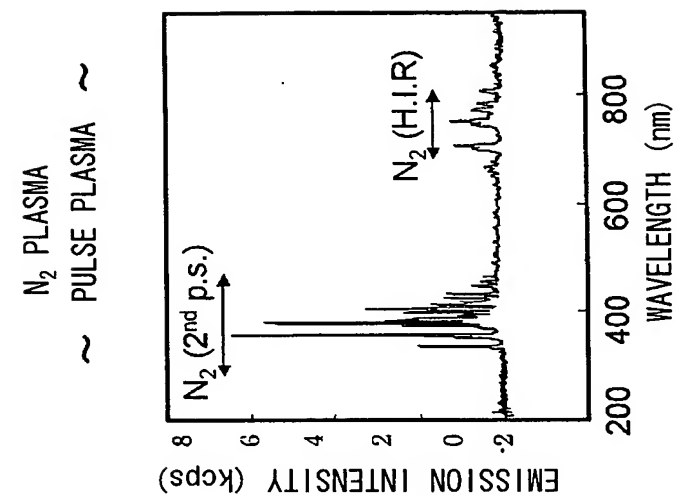
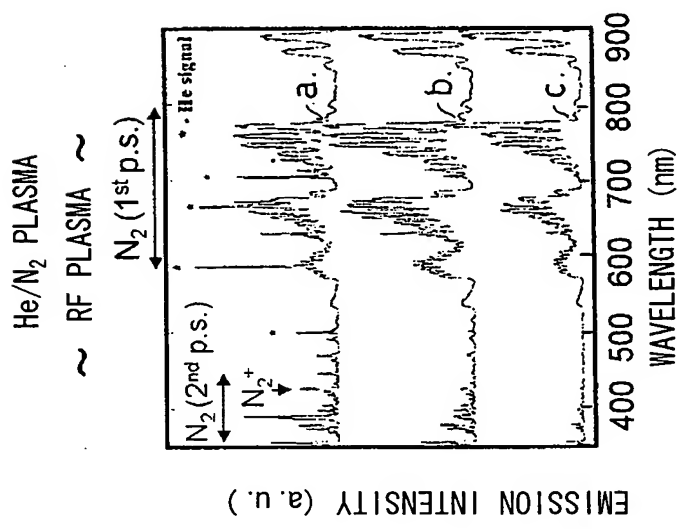
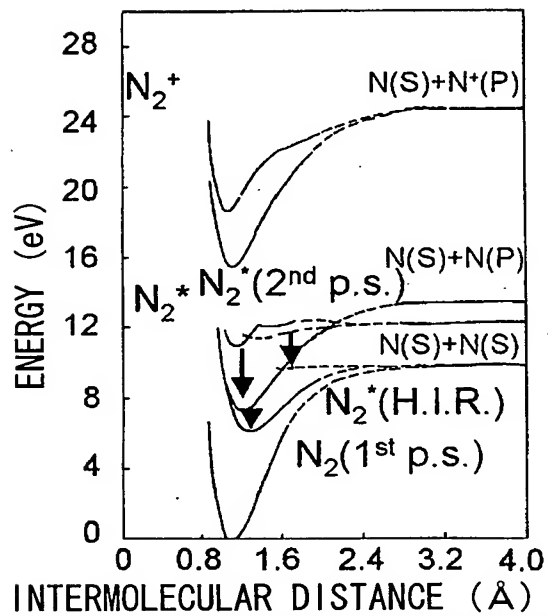


FIG. 10(a)



H. Niimi et al., J. Appl. Phys. 91, 48, (2002)

FIG. 11



A.N. Wright and C.A. Winkler, Active nitrogen  
(Academic, New York, 1968)

FIG. 12

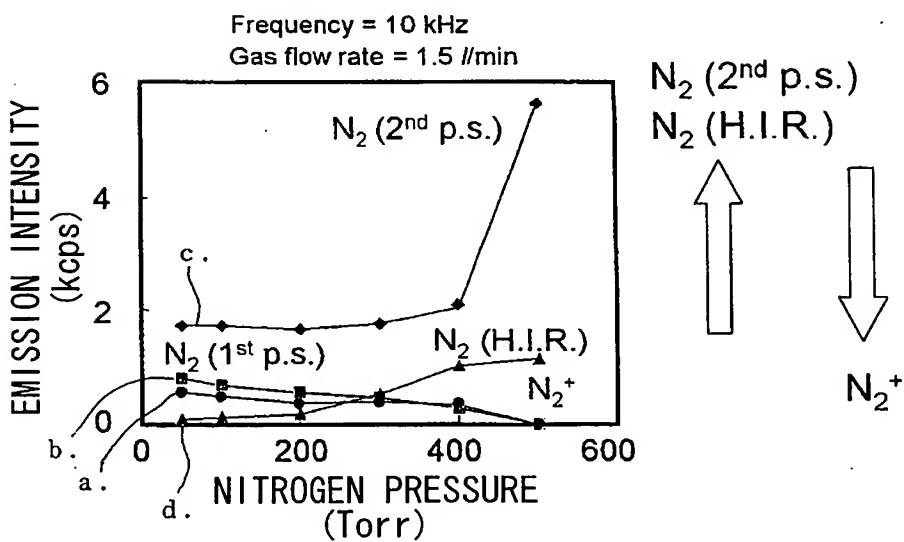


FIG. 13(b)

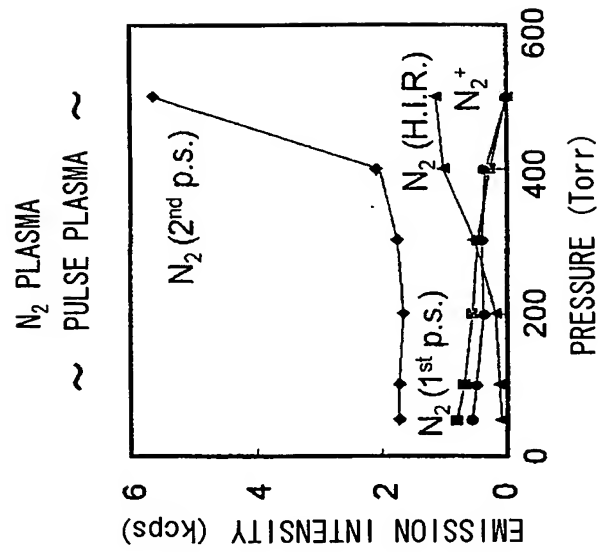
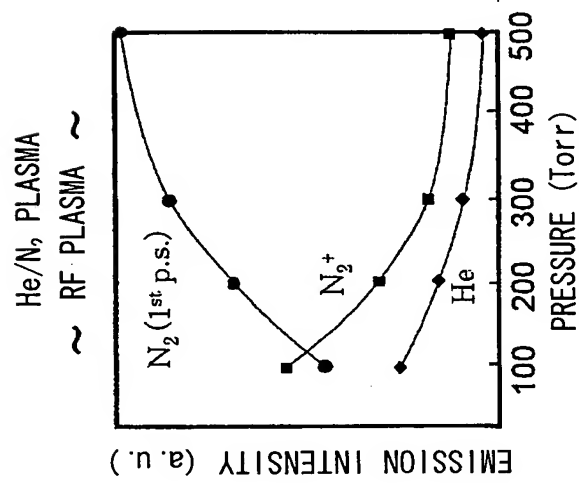


FIG. 13(a)



H. Niimi et al., J. Appl. Phys. 91, 48, (2002)



FIG. 14

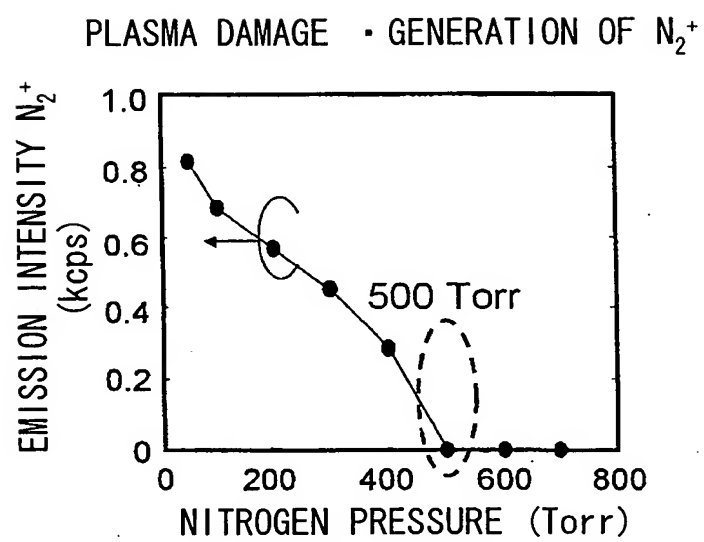


FIG. 15(a)

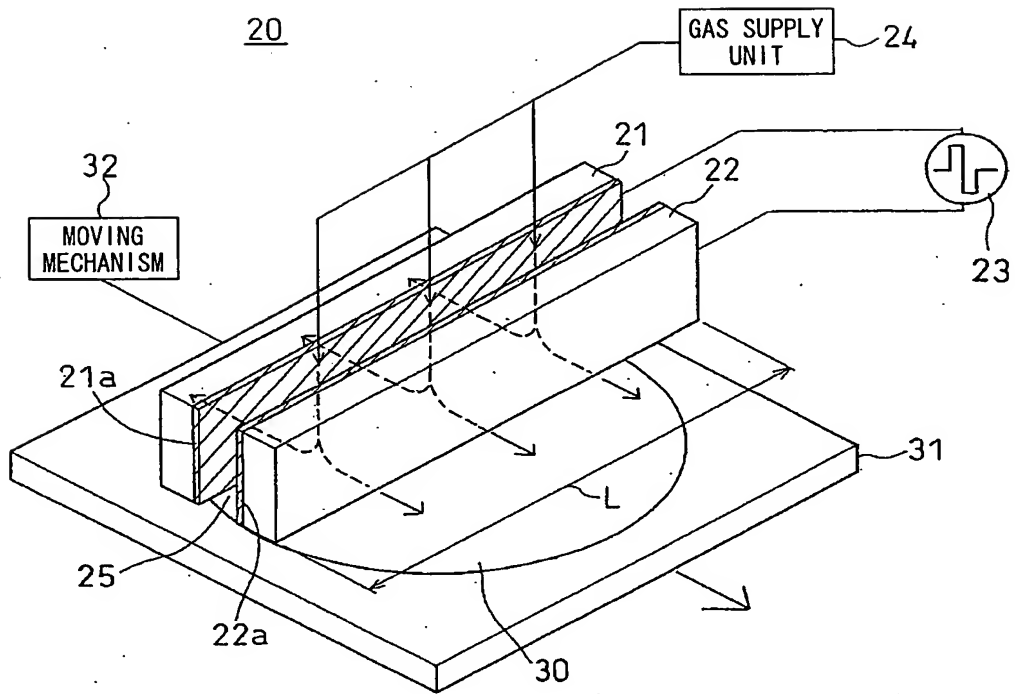


FIG. 15(b)

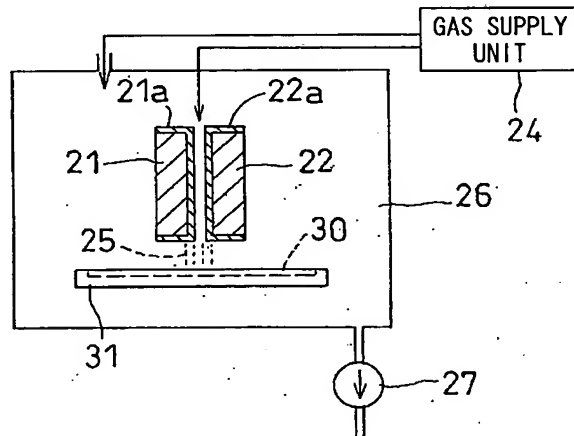


FIG. 16(a)

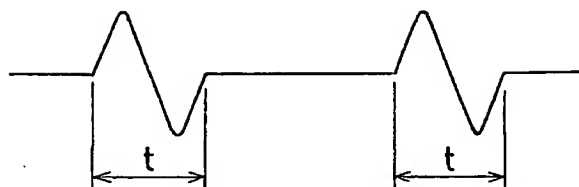


FIG. 16(b)

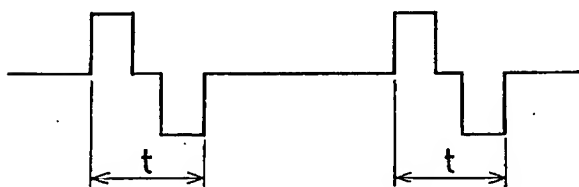


FIG. 17(b)

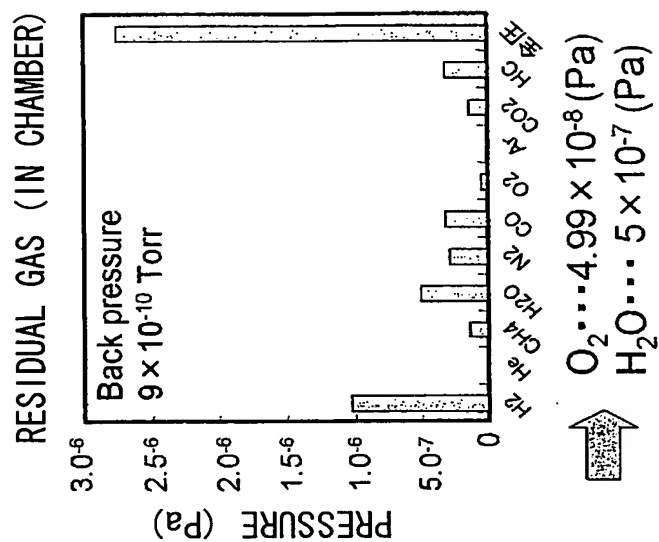


FIG. 17(a)

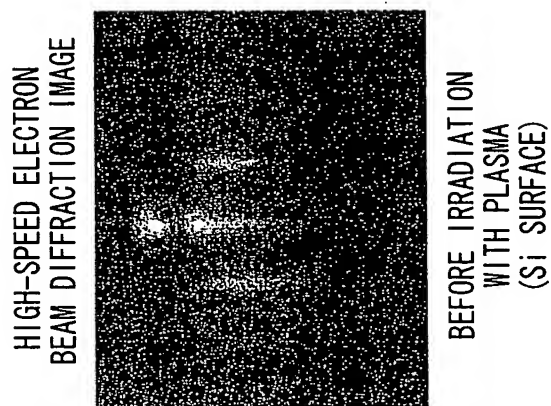
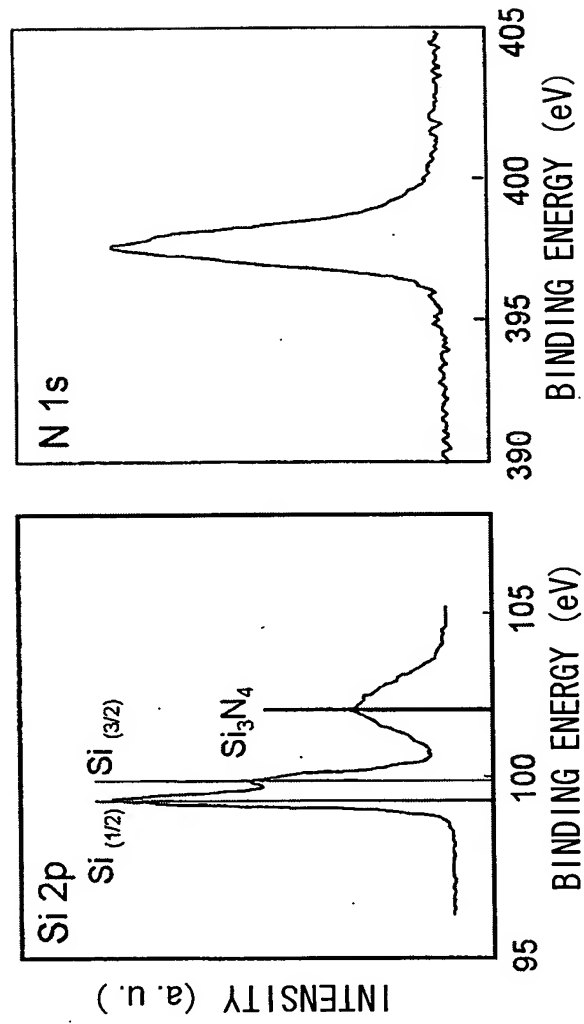


FIG. 18(a) FIG. 18(b)

HIGH-PURITY NITROGEN GAS : 99.9998%  
 HIGH-PURITY GAS FILTER  $\Rightarrow$  H<sub>2</sub>O, O<sub>2</sub> 1 ppb or less



$\Rightarrow$  FORMATION OF NITRIDE FILM (Si<sub>3</sub>N<sub>4.5</sub>O<sub>0.7</sub>)

FIG. 19(a)

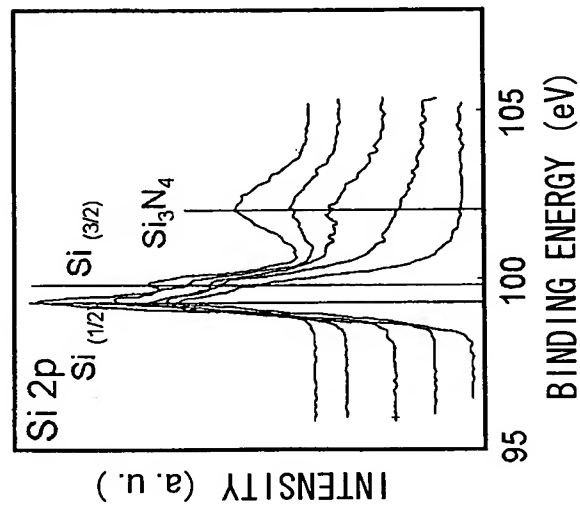
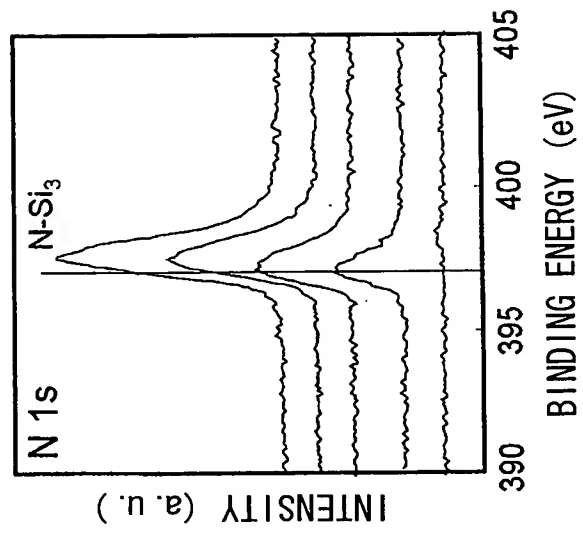


FIG. 19(b)



⇨ Si-N BONDING UNIFORMLY DISTRIBUTED

FIG. 20

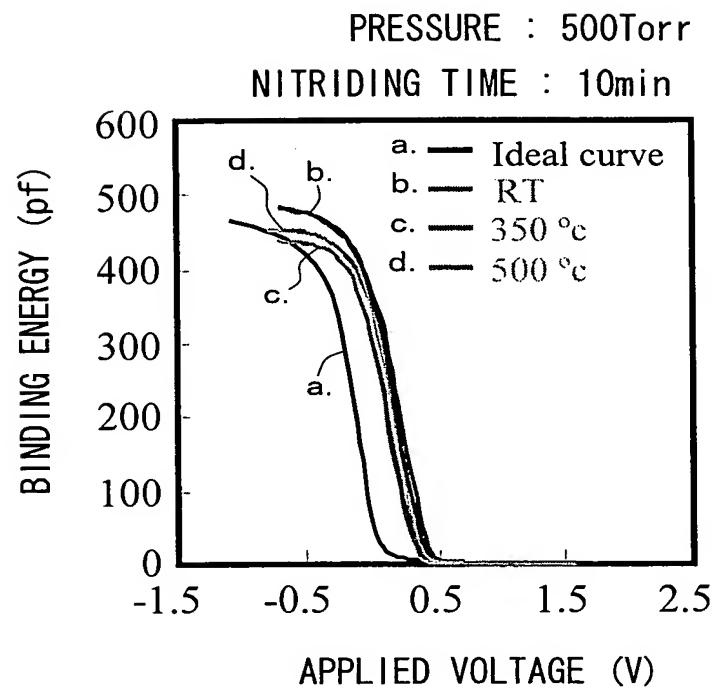


FIG. 21

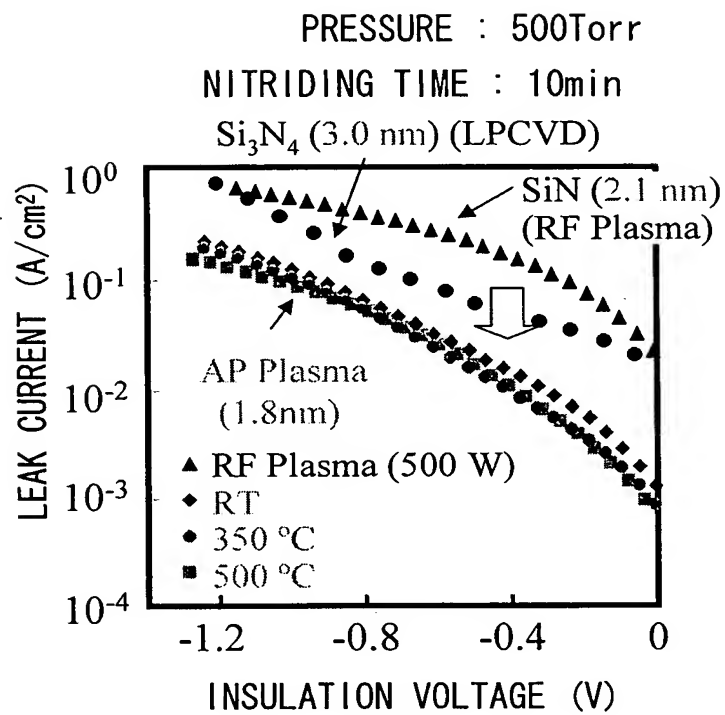




FIG. 22

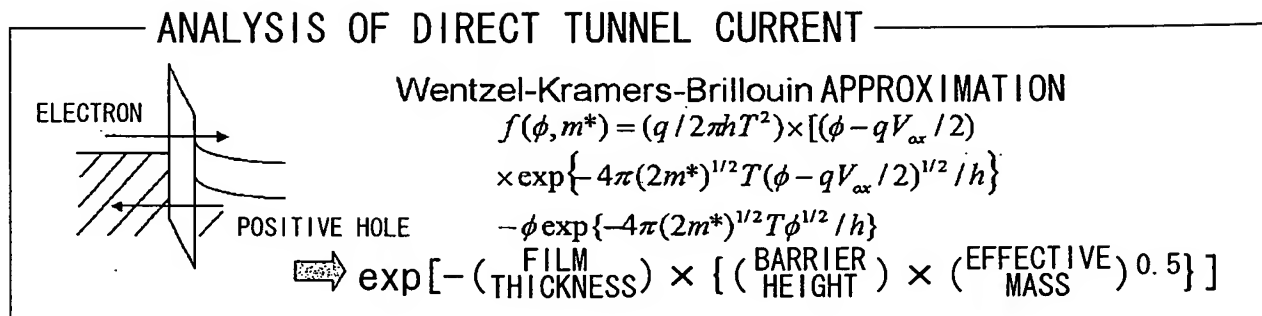


FIG. 23

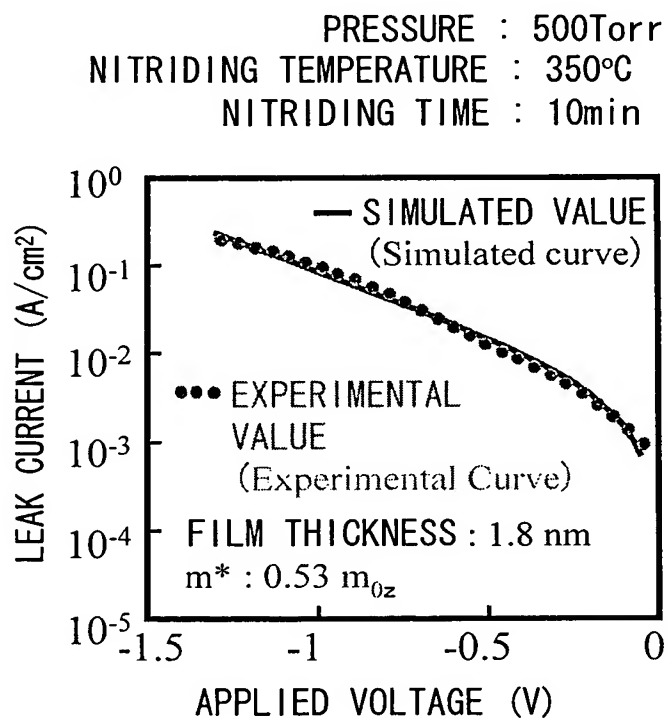


FIG. 24(b)

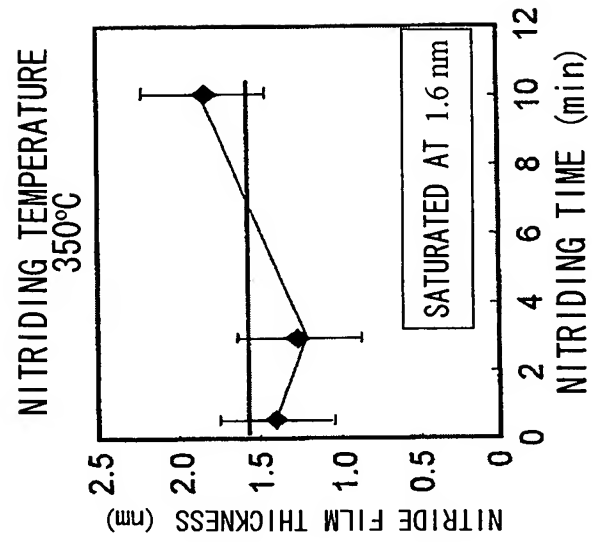
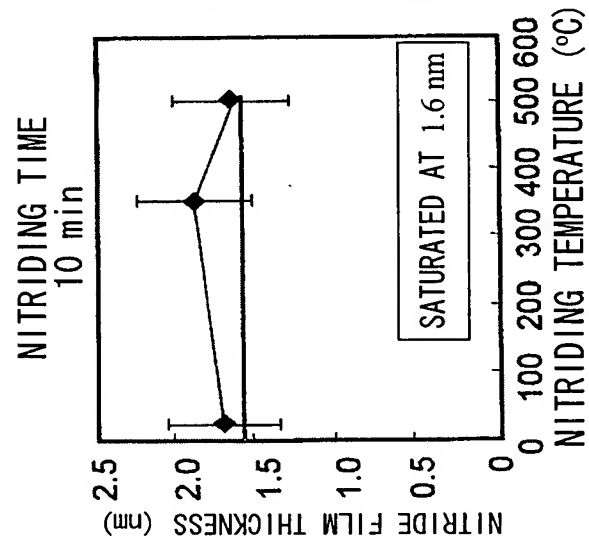


FIG. 24(a)



NITRIDING REACTION  $\Rightarrow$  NOT DEPENDENT ON NITRIDING TIME/TEMPERATURE

FIG. 25

NITRIDING TEMPERATURE : 350°C  
NITRIDING TIME : 10min

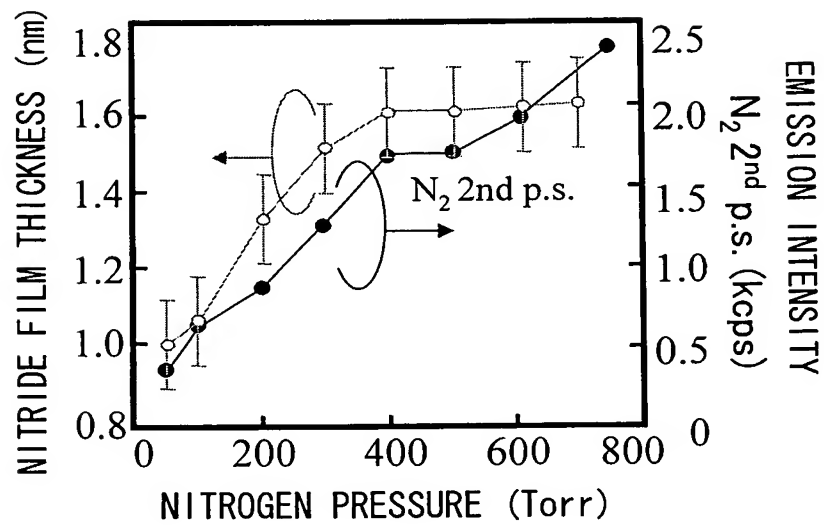


FIG. 26

NITRIDING TIME : 10min

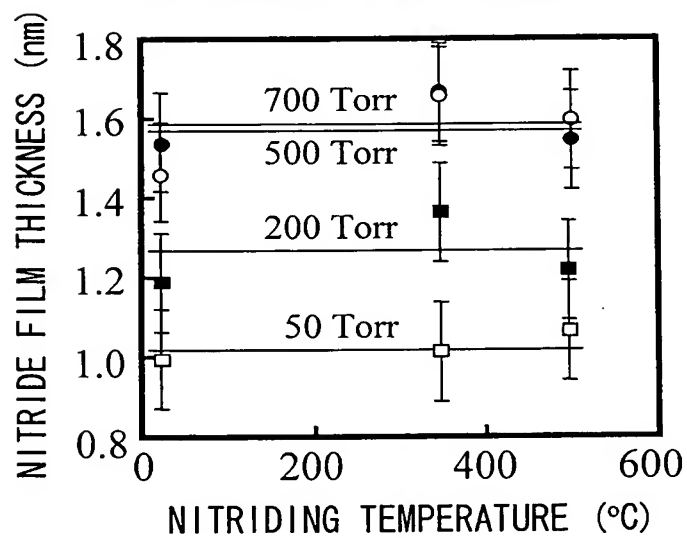


FIG. 27

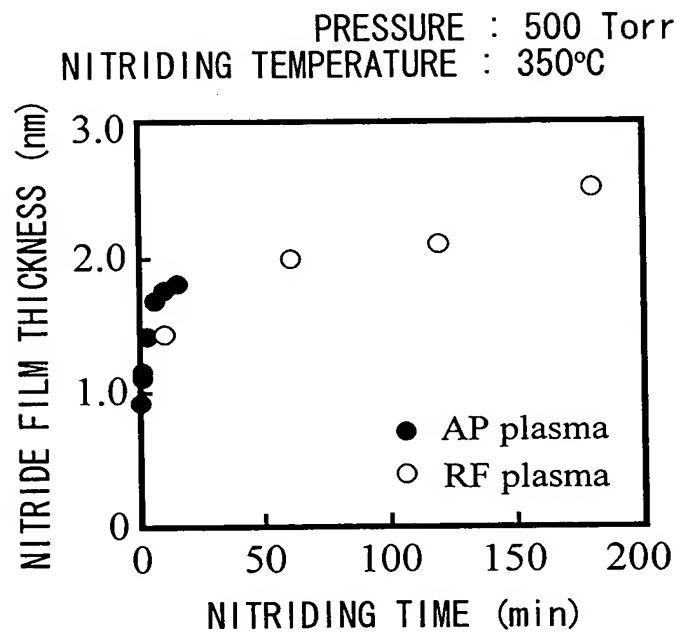


FIG. 28

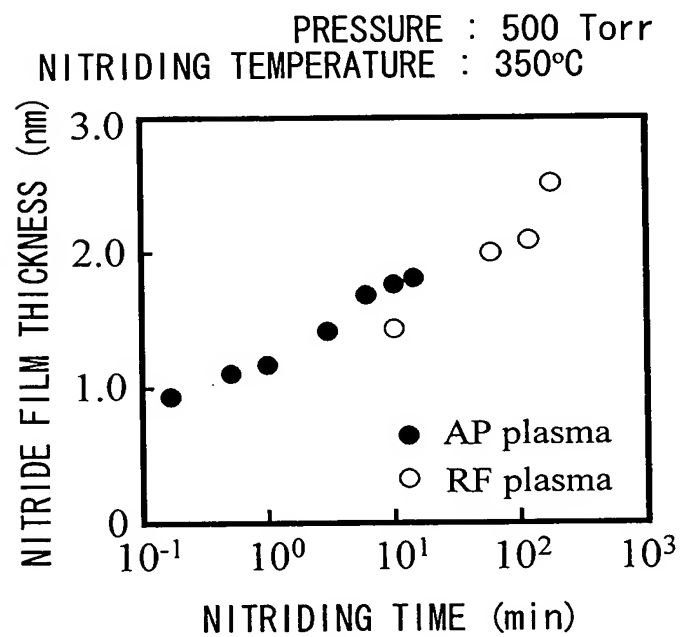
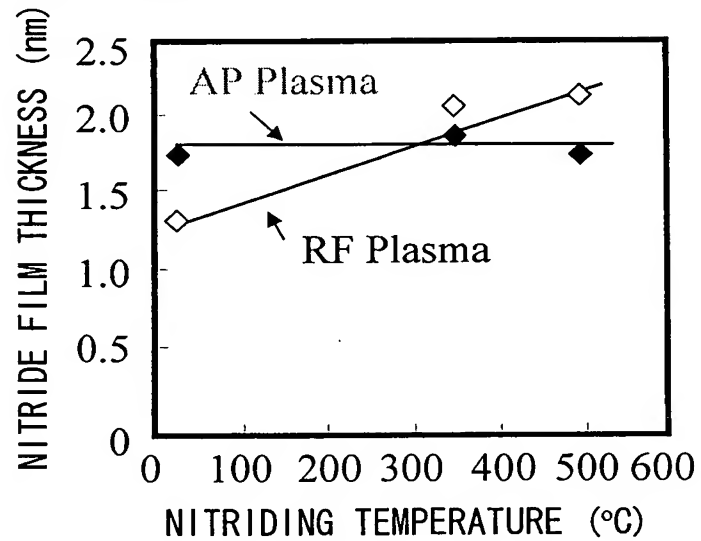


FIG. 29

ATMOSPHERIC PRESSURE PLASMA (AP plasma): PRESSURE : 500 Torr  
NITRIDING TIME : 10min

RF PLASMA (RF plasma ): PRESSURE :  $1 \times 10^{-5}$  Torr  
NITRIDING TIME : 60min



A schematic diagram of a 2D hexagonal lattice. The lattice consists of 12 vertices arranged in a hexagonal pattern. The top vertex is labeled '1'. Moving clockwise from the top, the vertices are labeled: '2' (top-right), '3' (right), '4' (bottom-right), '5' (bottom), '6' (bottom-left), '7' (left), '8' (top-left), '9' (top), '10' (top-right), '11' (right), and '12' (bottom-right). The edges of the lattice are labeled with Greek letters:  $\alpha$  for horizontal edges,  $\beta$  for edges at 60 degrees, and  $\gamma$  for edges at 120 degrees.

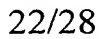


FIG. 31

.....  
SUBSTRATE

Si (111)  
.....

NITRIDING  
TEMPERATURE

ROOM  
TEMPERATURE

~500°C  
.....

RF PLASMA

PRESSURE

$1.0 \times 10^{-5}$  Torr

NITRIDING TIME 10 min. ~ 180 min.  
.....

ATMOSPHERIC PRESSURE PLASMA

PRESSURE

500 Torr

NITRIDING TIME 10 sec. ~ 15 min.  
.....

FIG. 32

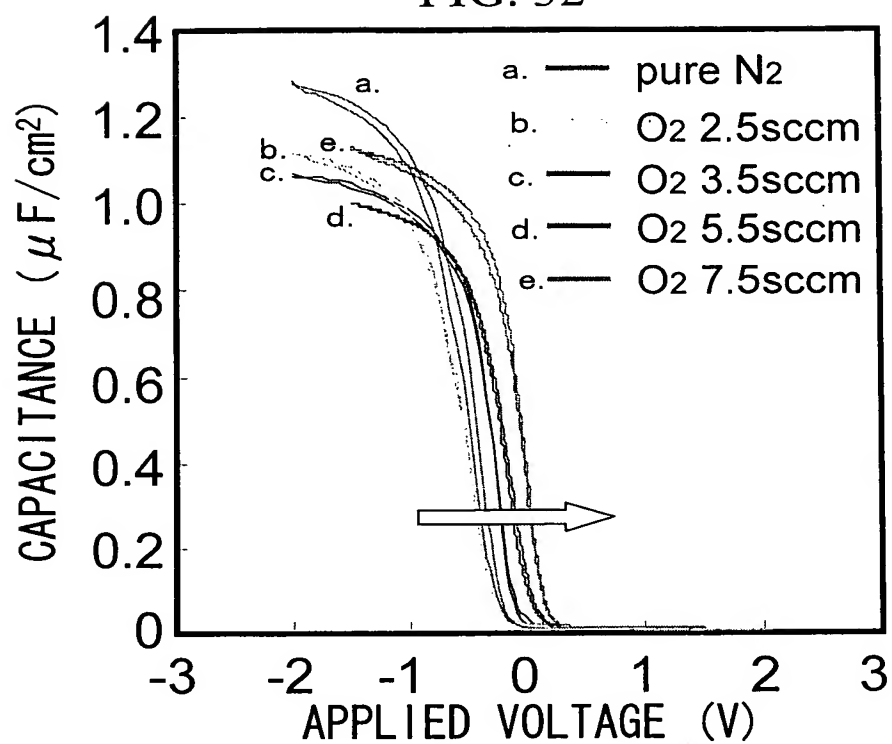


FIG. 33

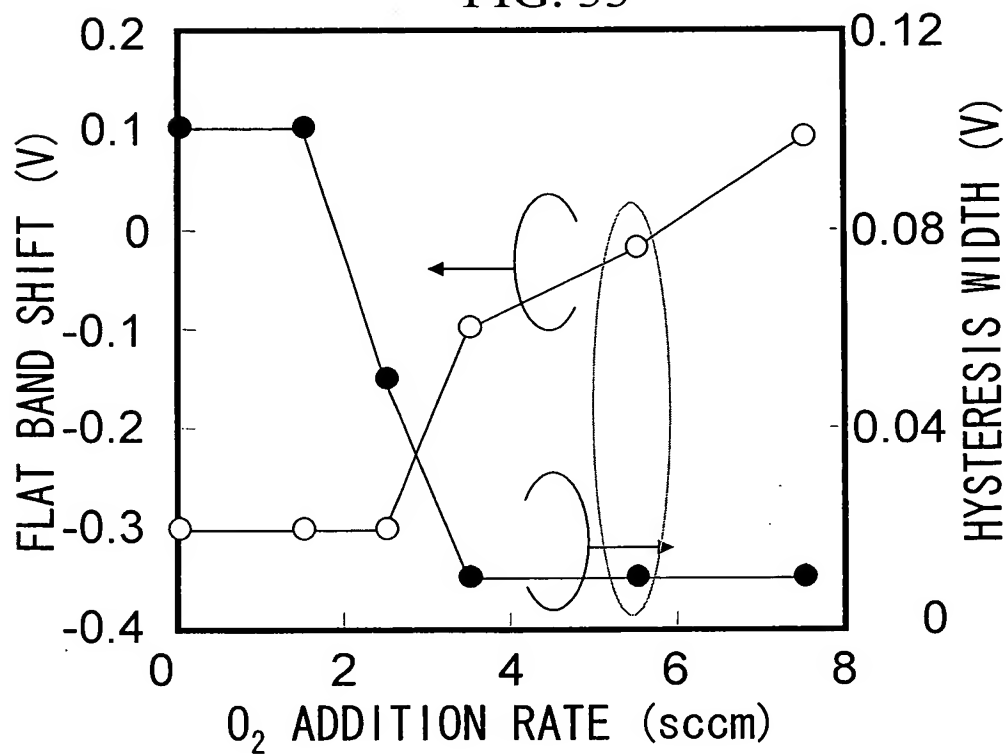
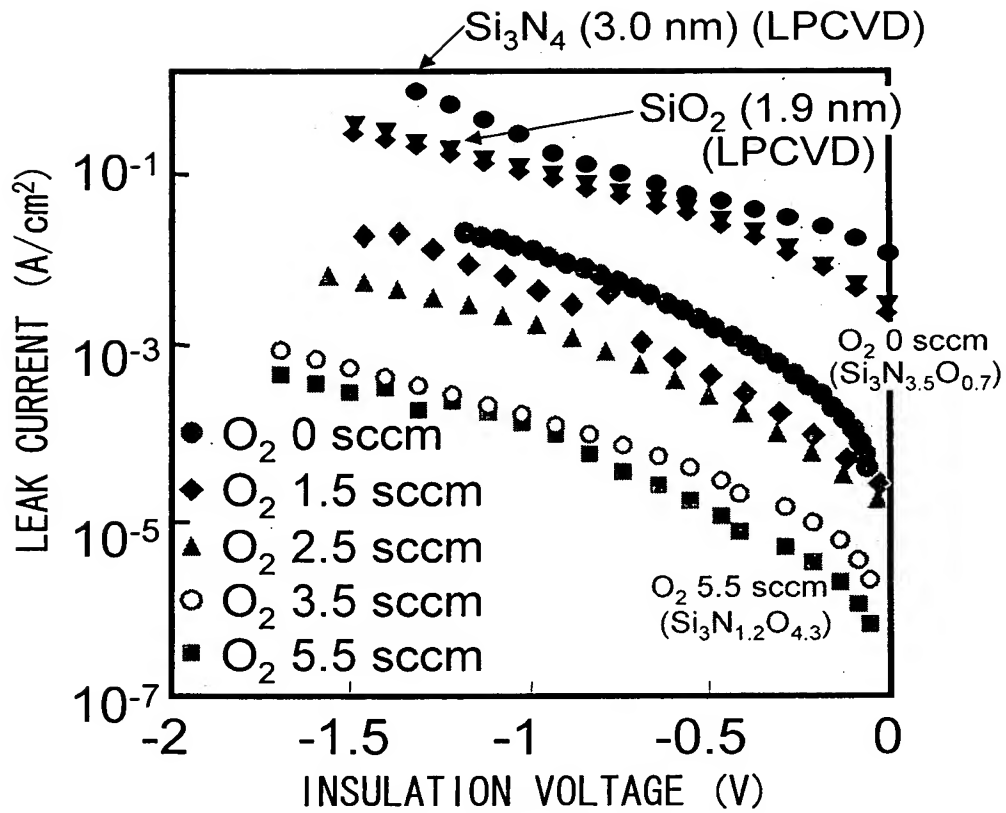




FIG. 34



Ref: K. Muraoka et al. J. Appl. Phys, 94, 2038

FIG. 35

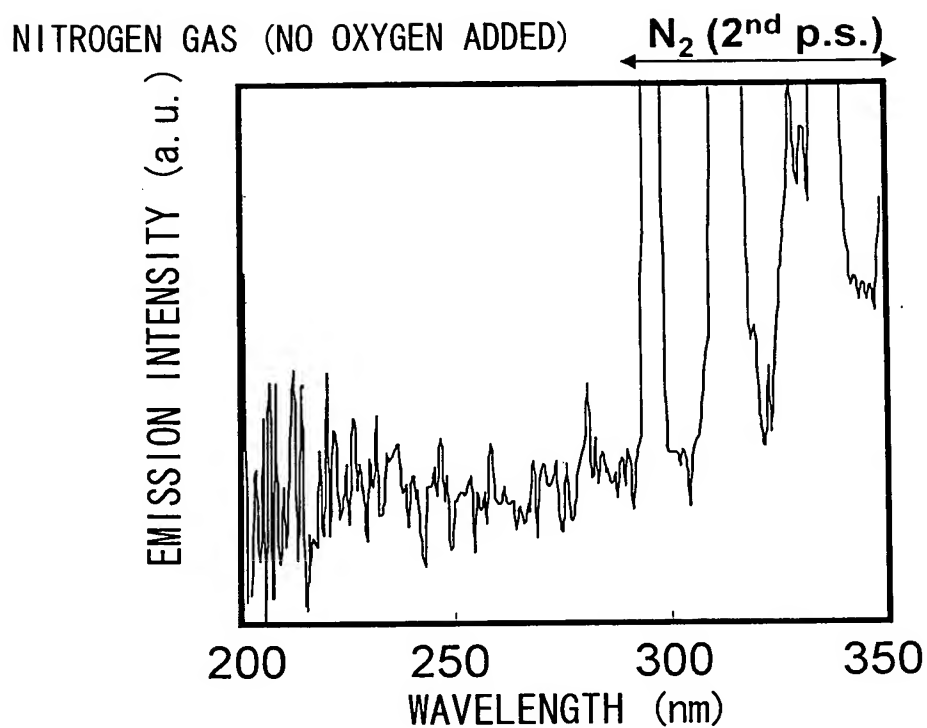


FIG. 36

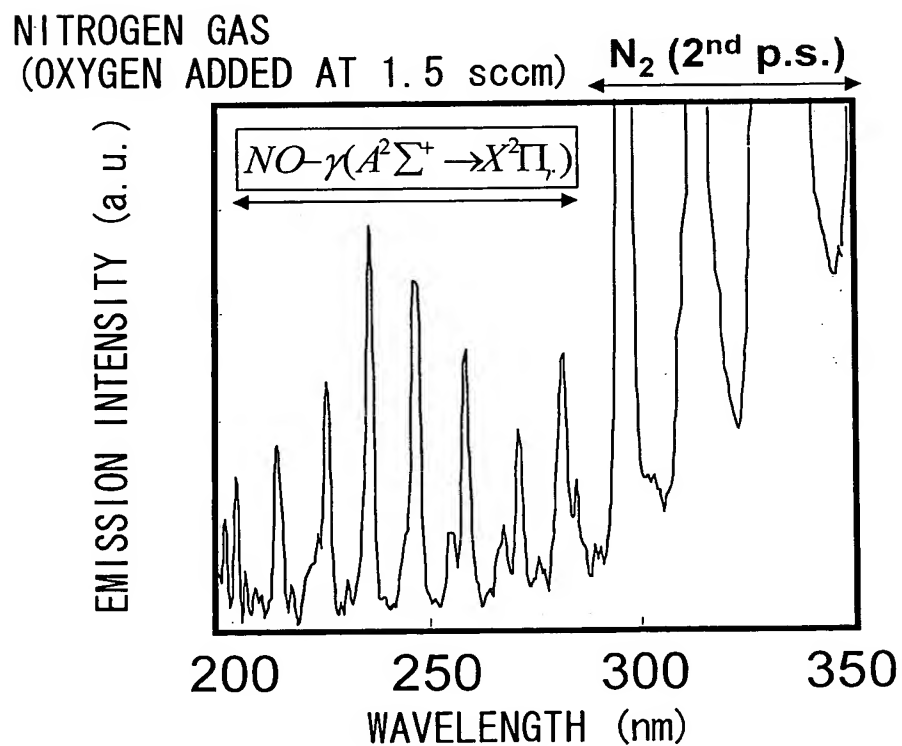


FIG. 37

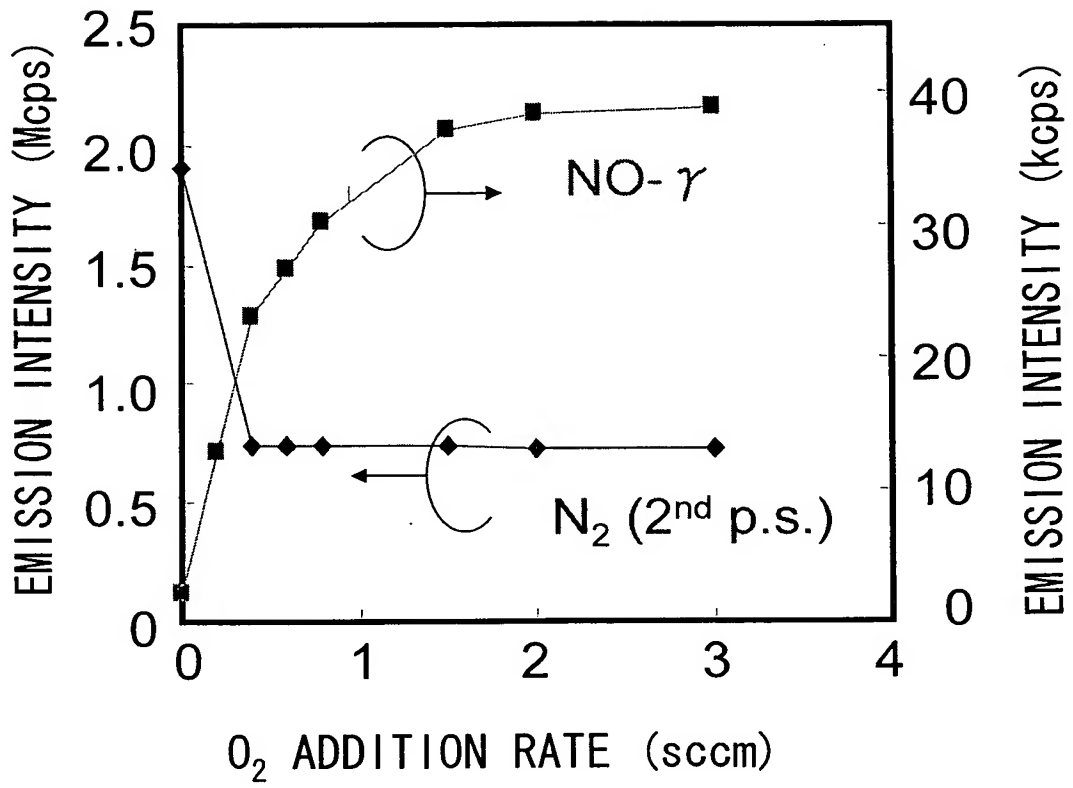


FIG. 38

NITRIDING TEMPERATURE : 350°C

NITRIDING TIME : 10min

